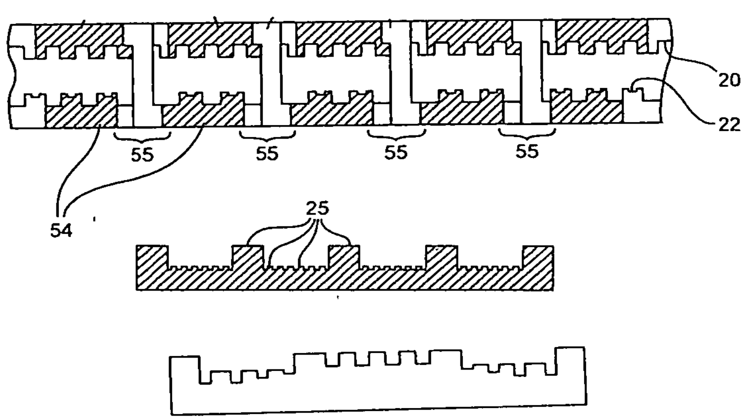
REMARKS/ARGUMENTS

In amended Fig. 2, the previously omitted element numeral 12 has been added.

Claims 1-12 and 29-32 remain in this application. Claim 3 has been allowed in a previous Office Action. No claims have been amended. New claim 33 has been added. Claims 13-28 have been withdrawn and cancelled as a result of an earlier restriction requirement. In view of the examiner's earlier restriction requirement, applicant retains the right to present claims 13-28 in a divisional application. Claim 33 is new.

Claims 1, 4-12 and 29-32 are rejected under 35 USC 112, first paragraph, because the specification, while being enabling for the electrolyte sheet having thicker and thinner areas and the thinner areas becoming progressively thinner closer to the edges, does not reasonably provide enablement for "thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edges."

The specification describes an electrolyte sheet with a varied thickness and a method of making such sheet (see paragraphs [0052]-[0053] of the specification. Paragraph [0053], for example, describes that the substrate layer may be patterned with the appropriate pattern embossed with a reversed pattern of derived indentations, before web casting or web coating with green material. The electrolyte sheet may have indentations or grooves of various sizes or depth (see, for example, Figure 17B), and some of the grooves or indentations may include more grooves, which change the thickness of the electrolyte sheet (see Figs. 4A and 4B of Applicants' Specification, and **Illustration A,** below).



The Examiner stated that paragraphs ([0104-01076]) teach that "middle is made thicker...no other types of changes to the thickness in a progressive manner are exemplified or mentioned in an instant application".

However, as described in Paragraph [00106], Figure 17B illustrates "<u>an embodiment</u> of the textured electrolyte sheet". Paragraph [00106] makes a broader statement- it explicitly states that "because <u>some</u> regions of the electrolyte sheet experience higher stresses, when pressurized, it is advantageous that <u>these</u> regions of the electrolyte sheet have larger average thickness than the regions experiencing more stress." This paragraph also refers to the central region being under a greater stress as a specific <u>example</u> of the above (broader) statement). Thus, Fig. 17B and paragraph [0106] should not be interpreted as teaching that the only possible thickness change is from a thicker middle toward thinner edges.

Figure 17B illustrates electrolyte thickness variation in a progressive manner, and in view of the above descriptions in paragraph [0106], this figure should not be interpreted as teaching that that high stresses will always be present in the center of the electrolyte sheet, and/or that the electrolyte sheet should always be thicker in the middle and progressively thinner towards the edges.

That is, the broad description in paragraph [00106] when viewed in conjunction with one exemplary embodiments depicted Fig. 17B supports Applicants claim 1 and should not be viewed as limiting to the electrolyte sheet with a thicker central area. In fact paragraph [00106] expressly states that experiencing more stress in the central region is only <u>an example</u>.

New Claim

Claim 33 is new. It is similar to claim 1, but specifies that electrolyte sheet "regions experiencing higher stress having an average thickness that are greater than the average thickness being of the regions experiencing lesser stress". This statement is supported, for example, by the language of claim 4.

Claims 1, 2, 4-12, 29, 30 and 32 are rejected under 35 USC 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) and evidenced by Fuel Cell Systems.

Claim 1 has specifies that the "electrolyte sheet includes thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edges". Neither one of the cited references discloses this feature. This feature is shown, for example, on Fig 17B of the Applicant's specification. It is noted that Fig. 13 reference of the McElroy does not disclose the electrolyte sheet "wherein said electrolyte sheet includes thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edges". Claim 1 also specifies that the electrolyte sheet is <u>flexible</u>. This feature is also not disclosed by either one of the two cited references.

The Examiner stated that in regards to claim 1, 2, 4-6 and 9 McElroy discloses a flexible ceramic yttria stabilized zirconia electrolyte. Applicants respectfully disagree with this statement. The McElroy reference does <u>not</u> disclose a flexible electrolyte sheet. McElroy is silent with respect to flexibility of the electrolyte sheet and more specifically, paragraphs [0087] and [0189] referred to by the Examiner are silent with regard to the flexibility of the electrolyte sheet.

The Examiner also stated (pg. 4 of the Office Action) that "The electrolyte sheet taught by McElroy is made from the same material and has the same thickness as disclosed by

the specification. Therefore, it is inherent that the electrolyte sheet is bendable to an effective radius of less than 20 cm and the ohmic resistance is less than 0.2 ohms/cm^2." Applicants respectfully disagree with this statement for the following reasons:

The McElroy reference is completely silent on the degree of flexibility (if any) exhibited by the electrolyte sheet. <u>Flexibility (</u>electrolyte sheet being bendable to an effective radius of less than 20 cm) <u>is not an inherent characteristic of the electrolyte sheet, and none of the cited references imply that it is</u>. It is not inherent that McElroy electrolyte is bendable to the effective radius of less than 20 cm or that it has the ohmic resistance of less than 0.2 ohms/cm^2, because these properties of the electrolyte sheet depend on: (i) overall or regional flatness, (ii) electrolyte sheet microstructure, and (iii) size and frequency of inclusions or defects.

For example, electrolyte sheet having inclusions of larger than certain size break when bending, and will not be flexible. If the electrolyte sheet is made by a different process than the one by the applicant, it may not be strong enough, or flat enough to provide the required degree of flexibility. Furthermore, the Mc Elroy reference discloses the electrolyte sheet up to 250 μm thick. An electrolyte sheet that is about 250 μm thick is <u>not</u> likely to be bendable to an effective radius of less than 20 cm and the ohmic resistance is less than 0.2 ohms/cm^2. Also, for example, 10 um thick electrolyte sheet, is likely to be fragile, and not bendable, because of inclusions, or lower strength due to a slightly different manufacturing process.

Regarding ohmic resistance, Applicant did discuss the conditions for operation of fuel cell (and thus for that resistance to be measured). The temperature conditions specify by the applicants fall in the 600ºC to 850º C range. For example, paragraph [0044] pf the Applicants' specification states: "This decrease in ohmic resistance and the increase in ionic conductance advantageously enables the electrolyte sheet **10** to operate at relatively low temperatures (i.e., below 725°C). Thus, one may choose to utilize the

electrolyte sheet of the present invention in the temperature ranges of 600°C to 725°C, as well as in the conventional temperature ranges of 725°C to 850°C." also, for example, paragraph [0088] states "Therefore, it is preferable that fuel cells which include electrolyte sheets of the present invention operate between <u>600° C and 850°C</u>."

In addition, it is <u>not</u> obvious that making the electrolytes sheets within the claimed thickness range and with the specific claimed thickness variations will not jeopardise electrolyte's integrity and strength. It is Applicants who realized that by making the electrolytes sheets within the claimed thickness range and with the specific claimed thickness variations, the electrolyte sheet will maintain its structural integrity, while the ohmic resistance will be improved beyond 0.5 $ohms/cm^2$ (see Claim 12).

Claim 9 depends on claim 1 and in addition states that the electrolyte sheet has an average electrolyte sheet thickness between 3 micrometers and 30 micrometers, and that <u>at least 50% of the area of the electrolyte sheet situated under said at least one cathode and said at least anode has a thinner body than the rest of the electrolyte sheet situated under said at least one cathode and said at least anode</u>. (See, for example, the last two lines of paragraph [0048] the Applicant's specification]. Claim 30 depends from claim 9 and further states that there are <u>multiple thinner</u> electrolyte sheet <u>areas under said at least one cathode and said at least anode.</u> Claim 32 depends from claim 9 and further states that <u>at least 75% of the area of the electrolyte sheet situated under said at least one cathode and said at least anode has a thinner body than the rest of the electrolyte sheet situated under said at least one cathode and said at least anode.</u>

The Examiner stated that "Since protrusions can have any shape, such as triangle, pyramidal or semi-spherical, these geometrical shapes provide an electrolyte sheet where at least 75% of the area of electrolyte has thinner body than the rest of the electrolyte sheet".

Applicants respectfully disagree with this statement. The portion of the area that has a thinner body is not determined primarily by the shape of the protrusions, but by the size of the protrusions, relative to the area around these protrusions. That is, if the thinner area is the area around protrusions, **(See below, illustration B),** the shape of the protrusion is almost irrelevant to how much of the area has a smaller body, and will not make 75% of the area (or 50%) to have a thinner body. That is, the size of the thinned area relates to the size of the protrusions and/or the size of grooved or the thinned areas.

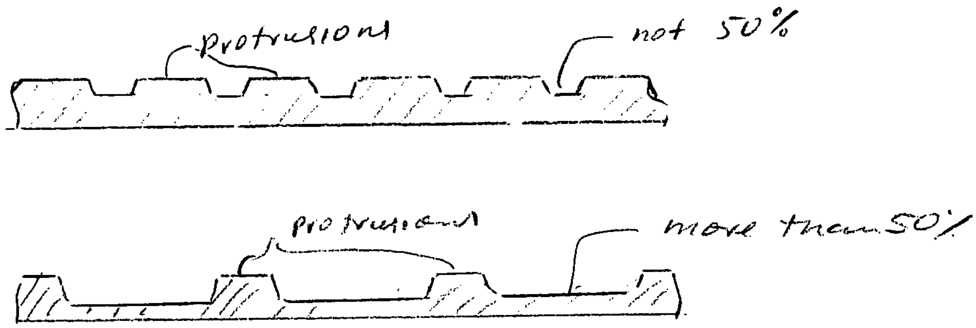


Illustration B

Claims 4-12 and the claims 29-32 depend from claim 1 as their base claim and, therefore, expressly incorporate the subject matter of claim 1. Accordingly, claims 1, 4-12 and 29-32 should now be allowable. Furthermore, claim 29 specifies that the electrolyte sheet <u>has ohmic resistance less than 0.2 ohms/cm^2</u> (see Paragraph [0045] for support), while claim 31 specifies that the <u>thinner areas</u> of the electrolyte sheet are textured. This feature is not disclosed by the cited references. More specifically, the Examine, on pg. 5 of The Office Action, in referring to Sasahara stated "The thinner sections of the electrolyte sheet are textured (Fig. 8 [0020, 0049])." However, as shown below (**illustration C**), Fig, 8 shows an electrolyte sheet that does NOT have thinner sections. The electrolyte sheet of Fig. 8 is a corrugated sheet with a uniform thickness T, and a textured surface. More specifically, the first pattern disclosed in paragraphs [0020, 0049] and shown in Fig. 8

is a rectangular corrugation pattern, which does not have, nor creates "thinner sections", but instead maintains a uniform thickness.

Illustration C

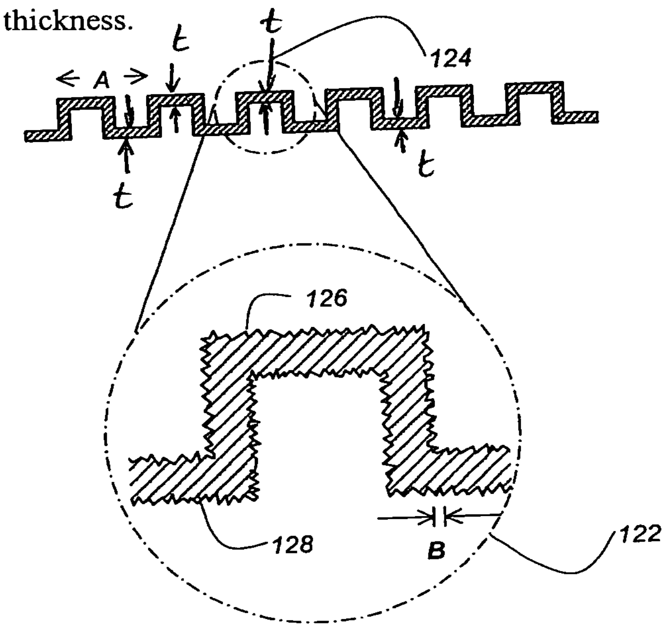


FIG. 8

Claim 2 is an independent claim. Claim 2 has been amended to state that the ceramic electrolyte sheet is flexible, has a substantially homogeneously non-porous body of a varied thickness with an average thickness of 3 μm to 30 μm, is bendable to an effective radius of curvature of less than 20 cm. The two cited references, neither together, nor in combination do not disclose this feature.

Claims 1, 2, 4-12 and 29-32 are rejected under 35 USC 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2002/0012825 (Sasahara) and evidenced by Fuel Cell Systems.

As stated above, claim 1 includes the following language: "wherein said electrolyte sheet includes thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edges." Claims 4-12 depend from claim 1 as their base claim and thus expressly incorporate this language. This feature is not shown in

either US Publication 2003/0165732 A1 (McElroy), US Publication 2002/0012825 (Sasahara), or the Fuel Cell Systems reference. Therefore, because the cited references, in combination, do not disclose this feature, claims 1 and 4-12 are not obvious over these references.

Claim 2 states that the ceramic electrolyte sheet is flexible, has a substantially homogeneously non-porous body of a varied thickness with an average thickness of 3 μm to 30 μm, is bendable to an effective radius of curvature of less than 20 cm. The three cited references, neither together, nor in combination, disclose these features. Therefore, claim 2 is patentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2002/0012825 (Sasahara) and evidenced by Fuel Cell Systems. As discussed above, being bendable is not an inherent property of the electrolyte sheet because the degree its bend-ability depends on: (i) overall or regional flatness, (ii) electrolyte sheet microstructure, and (iii) size and frequency of inclusions or defects.

The Examiner stated that "Sasahara teaches an electrolyte with three-dimensional features on one face of electrolyte .... The textured surface provides for a high reaction surface area-to volume ratio, thereby increasing the volumetric power density. The thinner sections of the electrolyte sheet are textured (Fig. 8 [0020, 0049])." Applicants respectfully disagree with this statement. Fig. 8 of the Sasahara reference shows a corrugated electrolyte of the same thickness t (see above illustration), with shallow texturing. It does not show an electrolyte sheet with "thinner areas" and a textured surface. Accordingly, because the cited references, in combination, do not disclose all the features of claims 1, 2, 4-12, 29, 30 and 32, these claims are not obvious in view of the cited references.

Claims 8, 9 and 11 are rejected under 35 USC 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of US Publication 2001/0044043 (Badding) and evidenced by Fuel Cell Systems.

Claim 8 depends from claim 1 and further specifies that electrolyte sheet thickness is below 45 μm.

Claim 9 also depends from claim 1 and further specifies that the electrolyte sheet thickness is between 3 and 30 μm. Claim 9 also specifies that "at least 50% of the area of the electrolyte sheet situated under said at least one cathode and said at least anode, has a thinner body than the rest of the electrolyte sheet situated under said at least one cathode and said at least anode". As discussed above, this feature is <u>not</u> taught or implied by any of the cited references.

Claim 11 specifies that the flexible electrolyte sheet has a thickness between 4 and 15 μm, which is also is not taught or implied by any of the cited references.

In addition, Claims 8, 9 and 11 depend from claim 1 as their bas claim and, therefore include the following language: "<u>wherein said electrolyte sheet includes thicker and thinner areas and the thickness of the electrolyte sheet changes progressively closer to the edges</u>". The three cited references (Publication 2003/0165732 A1 (McElroy), US Publication 2001/0044043 (Badding,) and Fuel Cell Systems), neither together, nor in combination, disclose this features. Therefore, claims 8, 9 and 11 are patentable over these references. Finally, it is noted that the <u>US application 09/858,125 (published as US Publication 2001/0044043, Badding) and the claimed invention were, at the time the invention was made, was owned or subject of obligation of assignment to Corning, Inc</u>.

Claims 1, 2, 4-12, 29, 30 and 32 are rejected under 35 USC 103(a) as being unpatentable over US Publication 2003/0165732 A1 (McElroy) in view of JP Publication 05-258756 (Kato) and evidenced by Fuel Cell Systems.

I. Claim 1 calls for "one side of said ceramic electrolyte sheet experiencing a predominately compressive force, the other side of said electrolyte sheet experiencing a predominately tensile force, wherein the side with a relatively smooth surface is subjected to the predominately tensile force and more textured surface subjected to predominately compressive force".

The Examiner stated that Mc Elroy is silent as to which electrode's textured surface faces. The Kato reference is directed to a different technology. The Kato electrolyte is made from a different material and because of it operates under different conditions. More specifically, Kato utilises an ion conductive polymer (NOT ceramic) and a polymer membrane based fuel cells cannot operate under the same conditions as solid oxide fuel cells (SOFCs) based on ceramic electrolytes. For example, fuel cells utilising proton exchange membranes made of polymers operate at temperatures below 100° (e.g. about 80 °C), while SOFCs based on a ceramic electrolyte typically operate at much higher temperatures of 600°C to 850 °C (see paragraph [0044]). <u>A polymer based electrolyte sheet of Kato would not be subjected to the same thermal/mechanical stresses associated with cycling through much higher temperature extremes. More specifically, a polymer based electrolyte sheet of Kato, if subjected to these higher temperatures would simply be burned up-i.e., destroyed!</u> <u>Thus, it is not inherent that the polymer electrolyte taught by Kato works in the manner of the ceramic electrolyte claimed in claims 1 and 2, nor that it is arranged in the manner claimed by Applicants, nor is it inherent that it experiences the types of pressures taught and claimed by the Applicants</u>. Nor would one of skill in the art look to polymer based electrolytes to solve a problem associated with ceramic electrolytes. Accordingly, claims 1 and 2 are unobvious over the cited references. Furthermore, Claims 4-12 depend from claim 1 as their base claim and, therefore incorporate the language of claim 1, accordingly, claims 4-12 are also not obvious in view of Kato and McElroy references. (It is noted that although the Kato reference is directed to fuel cell devices that utilize protonic exchange membranes made of polymers, the McElroy reference is directed to SOFC devices that utilize ceramic electrolytes. Thus, the two technologies are not compatible and the cited references themselves provide no reason for the substitution/modification suggested by Examiner). Furthermore, neither Kato nor McEroy show a change in thickness in a progressive manner (claim 1).

II. As Examiner knows, a prima facie case of obviousness requires a suggestion or motivation to combine, a reasonable expectation of success, and a teaching or suggestion of all claim limitations. (MPEP §2143.) The teaching or suggestion to modify the Kato and McElroy references in a manner suggested by Examiner must be found in the prior art; the teaching or suggestion to modify cannot be found in Applicant's disclosure. "Our case law makes clear that the best defence against the subtle but powerful attraction of a hindsight-based obviousness analysis is rigorous application of the requirement for a showing of the teaching or motivation to combine prior art references," In re Dembiczak, 175 F.3d 994, 999, 50 USPQ2d 1614, 1617 (Fed. Cir. 1999). "There must be some motivation, suggestion, or teaching of the desirability of making the specific combination that was made by the applicant." In re Dance, 160 F.3d 1339, 1343, 48 USPQ2d 1635, 1637 (Fed. Cir.1998). "Teachings of references can be combined only if there is some suggestion or incentive to do so," (emphasis in original). In re Fine, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1600 (Fed. Cir. 1988), quoting ACS Hosp. Sys., Inc. v. Montefiore Hosp., 732 F.2d 1572, 1577, 221 USPQ 929, 933 (Fed. Cir. 1984).

"Even when the level of skill in the art is high, the Board must identify specifically the principle, known to one of ordinary skill that suggests the claimed combination. In other words, the Board must explain the reasons one of ordinary skill in the art would have been motivated to select the references and to combine them to render the claimed invention obvious," In re Rouffet, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) "The examiner can satisfy the burden of showing obviousness of the combination 'only by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings of the references," In re Fritch, 972 F.2d 1260, 1265, 23 USPQ2d 1780, 1783 (Fed. Cir.1992).

However, there is no suggestion in either the Kato, or in the McElroy reference to orient the electrolyte as claimed in claim 1 and to provide a progressive thickness variation, nor do these references provide a reason for doing so. Claims 4-12 depend from claiml, and therefore explicitly incorporate the language of claim 1. Accordingly, claim 1 and 4-12 are not obvious over the cited art.

Claim 3 is rejected under 35 USC 103(a) as being unpatentable over US Patent 5,521,020 (Dhar) in view of US Publication 2002/0012825 (Sasahara).

On pg. 8 of the Office Action the Examiner stated "As pointed out in applicant's specification 9[104]), it is known to have a higher flow of air across the cathode, creating greater compressive force on the high-pressure side (airside) and a greater tensile fore on the fuel side. So it is inherent that the fuel cell, taught by Dhar, has predominately compressive force on the airside and tensile force on the fuel side.

Applicant's did NOT teach that prior art discloses "a higher flow of air across the cathode creating a greater compressive force on the high pressure side (airside) and a greater tensile force on the fuel side." Applicants were discussing the embodiments of the present invention and what how these embodiments typically operate. That is, the Examiner is pointing to the discussion under the Detail Description of Preferred Embodiment, and more specifically, that of Example 6 of the embodiments of the Applicant's invention. It is one of the features of the Applicant's embodiments described in the Applicant's specification that these devices operate with a higher air pressure across the cathode side, creating greater compressive force on that side, and a greater tensile force on the other side of the electrolyte sheet. It is Applicants, not the cited references, who provide this teaching. It is in description of Applicant's embodiments. Other types of fuel cells may not have this feature. For example, as described in the Applicant's 9/30/05 Response to the Final Office Action of 8/11/05, the Badding reference (2001/0044043) describes a fuel cell device configuration that does not have this feature. Thus, it is not inherent, nor obvious, that the electrolyte taught by Dhar is arranged in the manner claimed by Applicants, nor is it inherent that it experiences the types of pressures taught and claimed by the Applicants.

Accordingly, claim 3 is not unpatentable over US Patent 5,521,020 (Dhar) in view of US Publication 2002/0012825 (Sasahara).

Conclusion

Based upon the above amendments, remarks, and papers of records, applicant believes the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

Applicant respectfully requests that the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Reply timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Svetlana Z. Short at 607-974-0412.

Respectfully submitted,

DATE: 8/22/07

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